TO: [redacted]

DATE: 27 September 1957

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SUBJECT: Configuration C Improvement

1. The result of the Configuration C ground and flight test programs indicate that certain improvements can be made to increase reliability, performance or weight. In general, the improvement program can be divided as follows:

   a. Optical
      (1) Improved collimator for ground tests
      (2) Altitude focus fixture

   b. Mechanical and Thermal.
      (1) Reduced vibration of optics
      (2) Study of thermal effects

   c. Electrical and Electronic
      (1) Simplified gyro (Spring restrained rate gyro)

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2. A useful adjunct to the present 300" collimator is an auto-collimator described in attached memo. The present 300" collimator has limited usefulness unless improved adjustment means for the optical elements is provided. It is suggested that the supports for the glass be redesigned in order to improve the image quality by field adjustment.

3. A proposal for an altitude focus fixture using multiple flats and postive lenses was made. It is desirable to expedite manufacture and use of this device.

4. Vibration of the optical structure is caused by the following:

   a. High frequency vibration as induced by motors and gear trains.

   b. Impulse vibration due to solenoids.

   c. Low frequency vibration caused by caging transients.

A vibration study was conducted to determine whether the individual optical components were sufficiently affected by internal camera drives to exceed optical resolution of 60 l/mn. The tests were taken with all components operating except for the stereo actuator and alpha brake. Vibration occurring during the shutter pulse was evaluated and determined to be less than the design requirement. However the "G" Mirror was marginal but can be improved by a stiffer mounting which was previously suggested to RMS. It is not to be expected that the stereo actuator or alpha brake will be significant during the shutter pulse. However, this will be measured during the next test.

5. It would probably be useful to reduce vibration below what has already been accomplished to afford a larger margin of safety. Vibration sources due to various drives and actuators are tabulated below:

Optical Structure		Superstructure	
1. Shutter	2	1. Take-up Motors	2
2. Gyros	3	2. Metering Drive	1
3. Stereo Actuator	1	3. Tension Regulator	2
4. Oblique Drive	1	4. Stepping Switches	
5. Alpha Brake	1	5. Captivator Drive Unit	1
		6. Vacuum Solenoid	
		7. Stabilizer Solenoids	3

6. The effect of any drives or actuators mounted on the optical structure contribute most to image degradation since the vibration is not damped by much intervening structure. The greatest vibration contributor appears to be the gyros. Since these gyros are used to detect low frequency oscillation it is feasible to isolate the high frequency

vibration using relatively stiff vibration pads without introducing erroneous rates to the gyro. To provide further vibration isolation of the superstructure drives the most direct method is to use damping at the three support points between optical structure and superstructure.

7. Vibration induced by caging transients can be eliminated by using the mirror for IMC and the cager for only locking the configuration between photo runs. Drift can be minimized by making the configuration slightly pendulous and using the auto-balance to erect the configuration about the Pitch axis. Another possibility is to cage the camera every 8th. frame. Even caging every frame would no longer be a serious problem since the camera would not have to be returned to zero after a considerable travel caused by IMC of the configuration. Preliminary work to accomplish this objective indicates that the approach is feasible.

8. High frequency aircraft vibration can be isolated by vibration damping of the superstruction relative to optical structure as proposed in Paragraph 3. Low frequency vibration created by rapid caging can be eliminated by using the Rocking Mirror for IMC as suggested in Paragraph 4.

9. We have been advised that U.S. Time has improved the performance of their rate gyro subsequent to the one which was tested 18 months ago. By the use of this gyro, weight can be reduced by approximately

20 lbs., circuitry can be simplified considerably and vibration can be reduced significantly. It is suggested that we buy a U.S. Time gyro for test and evaluation as a possible substitute for the Hig-5 now is use.

10. Conclusions

1. Provide an auto-collimating attachment to the Dummy Platen.
2. Modify the 300" Collimator to incorporate adjustment for the glass.
3. Provide an Altitude Focus Fixture.
4. Stiffen the "G" Mirror Support Brackets.
5. IMC the Rocking Mirror and investigate reduced caging frequency.
6. Investigate the use of vibration pads between optical structure and superstructure.
7. Investigate replacement gyros for the Hig-5.

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